Following Cherry Quality from the Tree to the Can

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One item—the scarcity of cherries—overshadowed all others during the 1967 tart cherry season. The prime question of buyers was "Where can I obtain cherries?" not "How good are they?" Michigan had produced only 45% of a normal crop, or about 43,000 tons.

The cherry shortage brought about changes in attitudes and demands. Processors, competing with each other for fruit, often waived quality requirements. Growers, in view of record high prices, sought to harvest every single cherry. Since tree loads were light and hand picking was extremely slow, difficult, and expensive, a great demand for mechanical harvesters arose. Several new types of harvesters made their appearance. In all, about 350 harvesters were used in Michigan to bring in 47% of the crop. In doing this, the harvesters saved about 11,200,000 pounds of cherries, worth about $2,000,000, which would not have been harvested if they had to be picked by hand.

Our research group, comprising personnel of the USDA and Michigan State University, initiated mechanical harvesting of cherries about 10 years ago, and maintains a continuing interest in the development. One of our main objectives is to protect cherry quality. Accordingly, in 1967 we carried out tests on quality and looked for trouble spots in 15 different mechanical harvesting operations in southwest and northwest Michigan. Moreover, we followed the fruit through all of the processing stages. Our data can now be used in helpful ways to develop better methods and equipment.

QUALITY, YIELD, AND BRUISING

Mechanical harvesters cannot improve the "on-the-tree" quality of cherries. They can, however, damage quality. They can also hurt pack-out yield, an item of major importance. These effects are brought about through bruising; to a large extent bruising controls both quality and pack-out yield (pitted yield). From a quality standpoint, bruising promotes the development of scald, loss of red color, poor character and texture, and faulty pit removal. From the yield standpoint, bruising causes cherry shrinkage, increased culls, and decreased pitted yield. Where, when, and to what extent did bruising occur in 1967?

Comparison of Harvesters

Three main types of cherry harvesters were used in 1967: unit A comprised 1 or 2 inertia shakers with 2 inclined plane, self-clearing collectors positioned 1 to 5 feet above the ground; unit B comprised an inertia shaker with a roll-out collector cloth resting flat on the ground; and unit C comprised a hand-held shaker with an inclined plane collector positioned 1 to 4 feet above the ground. Units B and C were used on a commercial basis for the first time with cherries in 1967.

Bruising was sizable with all 3 types of harvesters in 1967, ranging from an average (17 tests) of 21% with unit A to an average (11 tests) of 36% with unit B (Table 1). The bruising, of course, reduced the pack-out yield, the greatest reduction occurring with fruit from unit B. In this case the average reduction was equivalent to a dollar loss of $3,480 per 100 tons of fruit (product worth 30c per lb.). The corresponding average loss with cherries from unit A was $2,160. We should point out that hand picked cherries were bruised also, although we do not know precisely the extent of bruise for 1967. In 1962 the estimated dollar loss from bruising by hand pickers was $1,500 per 100 tons of fruit (calculated at 1967 prices). The major portion of the losses would be borne by the processor.

TABLE 1. *A comparison of 3 types of mechanical cherry harvesters: degree of bruise, yield of pitted fruit, and cost considerations. Results concern harvest bruise only; the cannery bruise was avoided.*

Number of tests (1967)	Harvest unit	Description of harvester	Bruised cherries after harvest (estimated by finger test)	Yield of pitted cherries from 100 pounds of fresh fruit (accurate)	Dollar loss from decreased yield per 100 tons of fruit (estimated)
5	—	Control unbruised....	0%	85.4 lbs.	0
17	A	Inertia shaker with inclined plane collector	21	81.8	$2,160
11	B	Inertia shaker with roll-out cloth on ground.............	36	79.6	$3,480
2	C	Hand held shaker with inclined plane collector............	24	82.2	$1,920
Average commercial hand picked, 1962			....	82.9	$1,500

Effect of Tree Load

In 1967 many growers obtained satisfactory results and avoided excessive bruising with harvester unit B. Tree loads were light, many trees were small, and few open, unprotected pockets of cherries were formed on the collecting cloth. However, in tests with tall, heavily laden trees, bruising was considerable and a low pack-out yield (72.6%) resulted (Table 2). Apparently, bruising increased as (a) cherries fell an increased distance, (b) pockets formed on the collecting cloth, thus allowing falling cherries to strike other cherries, (c) increased numbers of cherries struck flat, hard surfaces, and (d) masses of cherries churned about during clearing of the collecting cloth. Probable corrective measures would be (a) clearing of the collecting cloth several times during the harvest of a single tree, and (b) installation of decelerator strips above the collecting cloth.

TABLE 2. *Harvester with roll-out cloth on ground: effect of tree load on bruise level, yield of pitted fruit, and dollar value of fruit. Results concern harvest bruise only; the cannery bruise was avoided.*

Number of tests (1967)	Cherries on tree	Bruised cherries after harvest	Yield of pitted cherries obtained from 100 pounds of fresh fruit	Dollar loss from decreased yield per 100 tons of fruit (estimated)
3	40 lbs.*	15%	82.4 lbs.	0
4	70	31	80.3	$1,260
2	270	69	72.6	$5,880

*Weight of cherries on average tree in 1967 was 50 lbs.; in normal year the weight is about 110 lbs.

Effect of Operator

Since the beginning of mechanical cherry harvesting we have known that the level of bruising depends partly on the operator. Some operators possess skill and know-how, others are not so gifted or are indifferent. Some variations in operator performance with similar equipment in 1967 are shown in Table 3. The average operator (B of Table 3) did a good job in holding bruising at an acceptable level. Some operators, however, were careless and bruised cherries so severely that major scald developed by the time of processing. These observations emphasize the importance of selecting a good operator.

TABLE 3. *Operator effect: variations in bruise level with similar harvesting equipment but different operators in 1967. Cannery bruise was avoided.*

Operator (mechanical harvesting)	Bruised cherries at harvest time	Scalded cherries at processing time
A	8%	1%
B (average operator)	16	4
C	21	29
D	24	32
E	32	55

Growers' Hidden Loss

Not many growers realize that they are penalized directly by harvest bruising; the raw product grade does not reveal bruising's hidden effects. Cherries shrink or swell in water according to the degree of bruise. Unbruised cherries gain weight, and bruised cherries lose weight (Table 4). For example, the bruised cherries of grower D lost 3.7% in weight in 8 hours prior to delivery to the processor. This loss was equivalent to a dollar loss of $1,330 (at 18c per lb. of fruit) for a 100 ton grower in 1967. Corresponding losses with lug handled cherries are still greater.

TABLE 4. *Does harvest bruise hurt the grower? Effect of bruise level on the weight of cherries prior to delivery to processor.*

Grower	Bruised cherries after mechanical harvest	Change in weight of cherries held in orchard tanks	Estimated dollar value of weight changes for 100 ton grower
A	4%	+0.4%	+ $145
B	7	0	0
C	18	−1.9	− $685
D	32	−3.7	−$1,330
Average machine harvest, 1967		−1.0	− $360
Average hand picked, 1967		1.6	

Processors' Loss

Secondary bruising continued to be a major source of trouble in 1967. After the harvest bruise, cherries usually are subjected to a series of additional bruises during rehandling at receiving stations and canneries. Damage from the secondary bruise may exceed that from the harvest bruise. For example, our tests in 1967 (Table 5) showed that the harvest bruise decreased pack-out yield by 2.5%, whereas the secondary bruise cut yield by an additional 4.6% In terms of dollars, the decreased yield triggered by secondary bruising was equivalent to an average loss of $138,000 per 5,000 tons of fruit. During a normal year, several canneries achieve a volume of 5,000 tons. Owing partly to excessive bruising both at harvest time and during rehandling, pack-out yields at many canneries fell to a record low of 77.0% in 1967.

Secondary bruising can be reduced cheaply and effectively by eliminating most of the rehandling steps and by cutting the severity of bruise. It would be advantageous to cool and hold cherries in their original orchard tanks until time of processing. To promote understanding, we urge each processor to evaluate the effects of secondary bruising in his own plant.

TABLE 5. *Harvest and cannery (secondary) bruises: effects on scald, yield of pitted fruit, and dollar value of fruit. (Average of 5 tests in 1967)*

Cherries and treatment	Scalded cherries at processing time (estimated)	Yield of pitted cherries from 100 pounds of fresh fruit (accurate)	Dollar loss from decreased yield per 5,000 tons of fruit (estimated)
1. Control, unbruised	0%	85.4 lbs.	0
2. Bruised at harvest, not rehandled	11	82.9	$75,000
3. Bruised at harvest, rebruised at cannery	55	78.3	$213,000
Average commercial cherries in 1967	—	77.0	$252,000
Average commercial cherries in 1962	—	82.6	$ 84,000

Summary

Bruising of cherries lowers both quality and pack-out yield. In 1967 harvest bruising cost some growers about $1,000 through cherry shrinkage in orchard tanks. Modifications to reduce bruising may be desirable in some of the new (1967) harvesting equipment when trees are heavily loaded. Skill of harvester operator strongly affected bruise damage. The secondary bruising at receiving stations and canneries was a prime cause of high scald counts, poor character scores, and reduced pack-out yields. It was estimated that secondary bruising cost some processors about $100,000 in 1967.

Acknowledgment

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